PAN-PACIFIC ENTOMOLOGIST
63(1), 1987, pp. 37–42

Nest-site Preferences of the Giant Honey Bee, *Apis dorsata* (Hymenoptera: Apidae), in Borneo

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Abstract.—The characteristics of *Apis dorsata* (Hymenoptera: Apidae) nest-sites in Sabah, Borneo, are described on the basis of 15 nest-bearing trees. Nests were consistently high in very tall trees, exposed, and commonly aggregated. These features are consistent with what has been reported from mainland populations of *A. dorsata,* but not with giant honey bees from the Philippines. This supports the hypothesis that these latter are a distinct species.

The giant honey bees form a distinct species-group within *Apis* and are sometimes treated as a subgenus, *Megapis* Ashmead. At the most conservative modern estimate, the group contains two species, the Himalayan *A. laboriosa* Smith and Indomalaysian *A. dorsata* Fabricius. On the other hand, Maa (1953) divided the latter species into three: *A. dorsata, A. binghami* Cockerell (= *A. zonata* Smith) and *A. breviligula* Maa. This assessment is tentatively accepted by Sakagami et al. (1980), and Roubik et al. (1985), though not generally by other authors.

The name *A. binghami* applies to the little-known populations of *Megapis* on Celebes and associated smaller islands; *A. breviligula* applies to all populations in the Philippine islands aside from the Palawan group; and *A. dorsata* applies to all other non-*laboriosa* populations, including those of Borneo and neighboring Palawan. The distinctness of *A. binghami* and *A. breviligula* is currently under biometrical investigation (S.F. Sakagami, pers. comm.). For convenience, we refer to all *Megapis* from the Philippines proper as *A. breviligula,* without implying that the taxonomic question is settled, and to all non-*laboriosa Megapis* as the *A. dorsata* group.

Wallace (1869) was among the early naturalists who commented on these conspicuous bees and his remarks will serve as a summary for what many later travelers noted. *A. dorsata* in Borneo, he said, "build huge honeycombs, suspended in the open air from the underside of the lofty branches of the highest trees." He remarked especially on an aggregation of three nests that he watched being robbed by a team of men. The man who climbed the tree and cut down the combs protected himself with a heavy cloth wrapping and a smoke-torch, but was nonetheless repeatedly stung.

Morse and Laigo (1969) provided most of what is known of the biology of *A. breviligula* and reviewed the literature on both *A. breviligula* and *A. dorsata.* Since then, Deodikar et al. (1977), and Seeley et al. (1982; summarized by Seeley

1983) have contributed important new information on the biology of *A. dorsata* on the Asian mainland.

In this paper we describe nest-sites and colony aggregations of *A. dorsata* from Sabah and compare these taxonomically with data for *A. breviligula.*

Materials and Methods

All observations from Sabah were made during May, 1985. Trees with active colonies of *A. dorsata* or which had had colonies in them were identified along the highways between Tamparuli-Marak Parak via Kota Maruda and between Ranau and Sandakan (lat. 6°N, long. 117°E). In most cases initial discoveries were made from the road. The nests were then often observed through binoculars and by approach on foot to the tree. *A. dorsata* trees were initially recognized by the presence of active colonies or parts of a honey hunting ladder, and in one case by vestiges of a nest (comb-scar).

Results

Table 1 lists characteristics of the 15 nesting trees we found. Although we did not specifically search low vegetation, we saw no indication of *A. dorsata* nesting anywhere except on tree branches, an observation supported by the local people we contacted. All the trees were very tall, and we estimate that none had branches lower than 15m. Moreover, unlike many other trees of similar size and shape, the trees with bees were all clean and free of epiphytes or lianas on the trunk and main branches (Figs. 1, 3, 4). Almost all the nests were in open, unencumbered zones, without vegetation close to them. As seen in Table 1, a majority of the trees were smooth-barked. These had light-medium gray bark and appeared to be a single species. The usual tree for *A. dorsata* in that area is reported to be *Koompassia* [Fabaceae], (Orolfo 1965; Anthea Phillips pers. comm.). The description of *K. excelsa* (Becc.), one of the world's tallest known angiosperm tree species, agrees well with the trees, we observed. In addition, Corner (1952) remarked of *K. excelsa* that, "the branches often bear large combs of wild bees" in Malaya and cites a local name for it, *tualang,* meaning "tree of swarming bees." Roepke (1948) also noted a tendency for *A. dorsata* to nest in *Koompassia.* The bark of the three putative *Koompassia* trees that we closely inspected was smooth, hard, and compact, with no sign of flaking (Figs. 1, 2).

Many areas in which the bee trees were found had great numbers of tall, standing dead trees, as a result of habitat destruction through logging. Nonetheless, all eight trees with active bee colonies were living, as were six of the seven trees with signs of previous colonies (Table 1).

At least 10 of the 15 trees contained a ladder or vestiges of one going up the trunk to the bottom branches (Table 1, Fig. 2). Some of the other trees also might have had ladders, on a side hidden from us. The main part of the ladder consists of a series of sharp stakes with fire-hardened tips, from an exceptionally dense, hard dipterocarp tree, driven directly into the bee tree (Charles Jackson, pers. comm.). These are then lashed with rattan (*Calamus* sp. [Palmae]) to a bamboo upright (Fig. 3). Inasmuch as at least three of the trees with active colonies in them had vestiges of ladders—an indication that they had probably been hunted successfully at least once before—it seems likely that some trees are hunted repeatedly.

On eight trees we observed 22 active nests of bees in groups of 1–7 nests per tree

Table 1. Characteristics of nesting trees of *Apis dorsata* in Sabah.

Tree Bark	Ladder	Number of Active Colonies	Remarks
rough	+	0	
rough	+	0	
rough	−	⩾ 2	possibly one or two other hidden nests
semi-rough	−	1	
smooth	+	0	dead tree
smooth	+	0	
smooth	+	0	
smooth	+	0	
smooth	+	1	
smooth	+	3	
smooth	+	7	on two adjoining trees
smooth	−	0	definite comb-scar
smooth	−	4	
smooth	−	4	
smooth	−	7	
% of total trees	60% ladders	53% active	

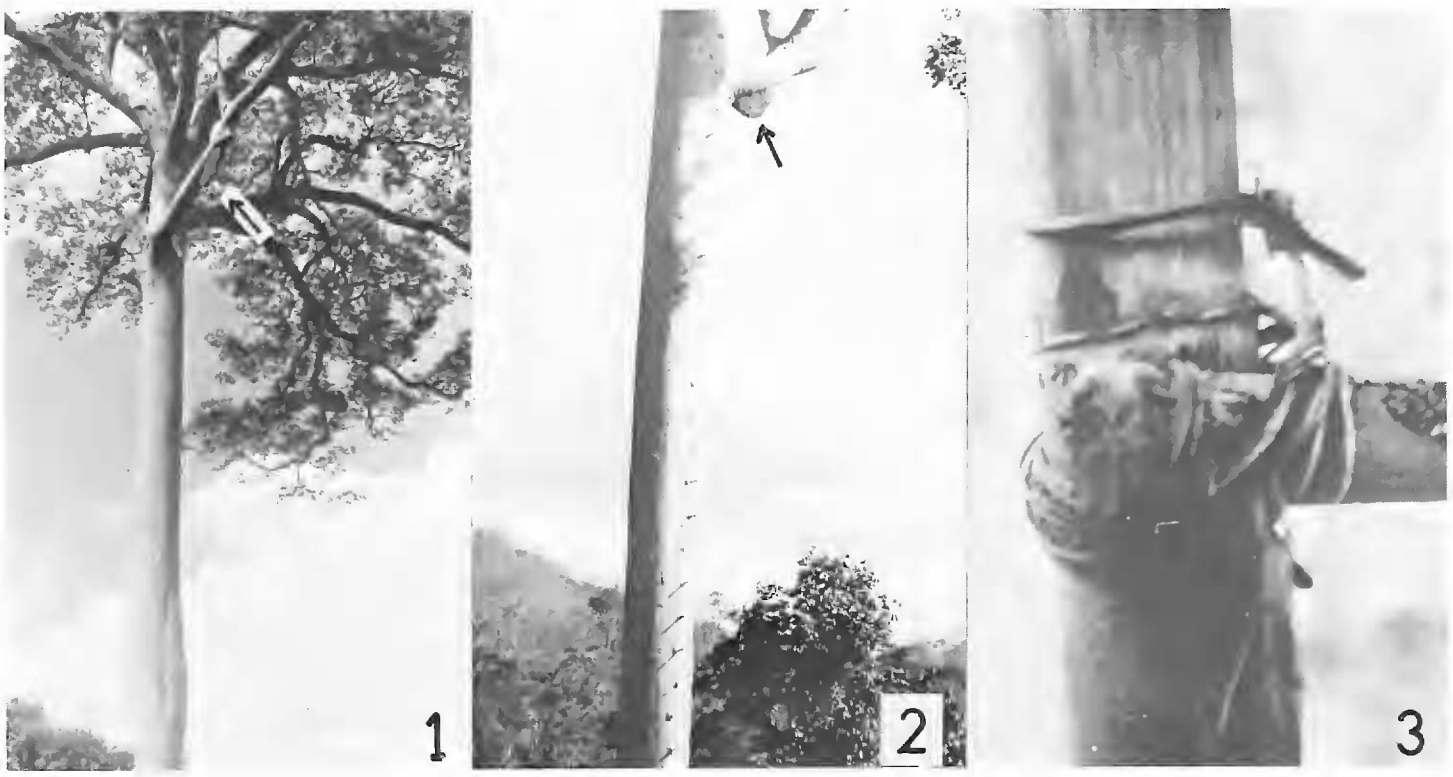
(Table 1). In those trees with multiple nests the nests appeared to be widely dispersed amongst the lower branches (Fig. 4), and certainly, no strong clumping within a tree was evident.

In the Philippines, one of us (CKS) has seen five swarms of *A. breviligula* on the island of Leyte and two of *A. dorsata* on the island of Palawan. These were all on the undersides of gently sloping branches. They resembled colonies with nests, but were more compact, i.e. forming a shallow, distinctly broader mass (Fig. 5). In a residential area of Kota Kinabalu, Sabah, we collected a small swarm of *A. dorsata* on a tree branch about 4m from the ground (Fig. 5). It appeared to have approximately one-tenth the volume of the five more uniform swarms mentioned above. Our collection, which appeared to encompass virtually all the bees in the swarm, comprised 1114 workers and 171 males. No queen was among them.

Discussion

Deodikar et al. (1977) reported observations on 1860 *A. dorsata* nests in India. Of these, 55% were in trees, the rest on human-made structures. The majority of nests were between 6 and 12 m above ground, with only 6% lower down. Seeley et al. (1982) described 15 trees in Thailand with *A. dorsata* nests. Fourteen of these were straight, smooth-barked, and limbless for at least 13m. Although the lowest nest was only 3.5m above the ground, most nests were located at heights between 13 and 27m, and all were in open vegetation. These observations agree with ours from Sabah, as well as with various other reports on the nesting of *A. dorsata* (Morse and Laigo, 1969).

Seeley et al. (1982) also reported a significant tendency for colonies to aggregate, with up to 24 nesting in a single tree. Morse and Laigo (1969) reported that most colonies seen by Morse in India were also aggregated, the largest aggregation being



Figures 1–3. 1. Typical bee tree, showing height, smooth bark, and lack of epiphytes. *A. dorsata* colony is visible (arrow). 2. Vestiges of honey-hunting ladder on bee tree trunk. This ladder allowed access to the position of the lowest colony (arrow), and also went higher into the tree. 3. Detail of one step of honey-hunting ladder, just beginning to disintegrate.

34 colonies, and Deodikar et al. (1977) likewise reported nests generally aggregated. Even larger aggregations, the greatest number being 156 in a single tree (see Morse and Laigo, 1969, for citations), have been noted. These observations led Morse and Laigo to conclude that trees with 20–30 colonies of *A. dorsata* are not rare throughout most of its range.

The nesting characteristics of *A. breviligula* as reported by Morse and Laigo (1969) from 30 colonies in Luzon, Philippines, and corroborated by one of us (CKS) from five colonies in Leyte, are in strong contrast to the above. A number of consistent differences are apparent:

a. *A. breviligula* nests are lower; they are rarely found in high trees, and often the bottom of the nest is within 1m of the ground.

b. It shows no preference for smooth-barked trees.

c. It tends to nest less in the open, often in the midst of fairly dense vegetation, so that the nests are much less conspicuous from a distance. Some nests even had small branches projecting through them.

d. Colonies of *A. breviligula* are single, not aggregated.

Morse and Laigo (1969) explicitly noted the first and last of these contrasts between *A. breviligula* and *A. dorsata* and remarked on these "subtle differences." In our view, they are important and lend support to the hypothesis that *A. breviligula* is a distinct species. The significance of our observations is strengthened by the fact that they were made in Sabah, very near the Philippines proper. If the two forms were the same species, we would expect bees from Sabah to be intermediate between those of Thailand and Luzon. With regard to nesting characteristics, this prediction is not corroborated. The distinct-species hypothesis further predicts that bees in Palawan will not differ significantly from those of Sabah, in the direction of resembling those of Luzon. This has yet to be tested.

Seeley et al. (1982) account for the nesting habits of *A. dorsata* as part of their defensive strategy against vertebrate enemies. The keys to this strategy are

Figure 4. Crown of bee tree with four active colonies and parts of one old nest in view (arrows).

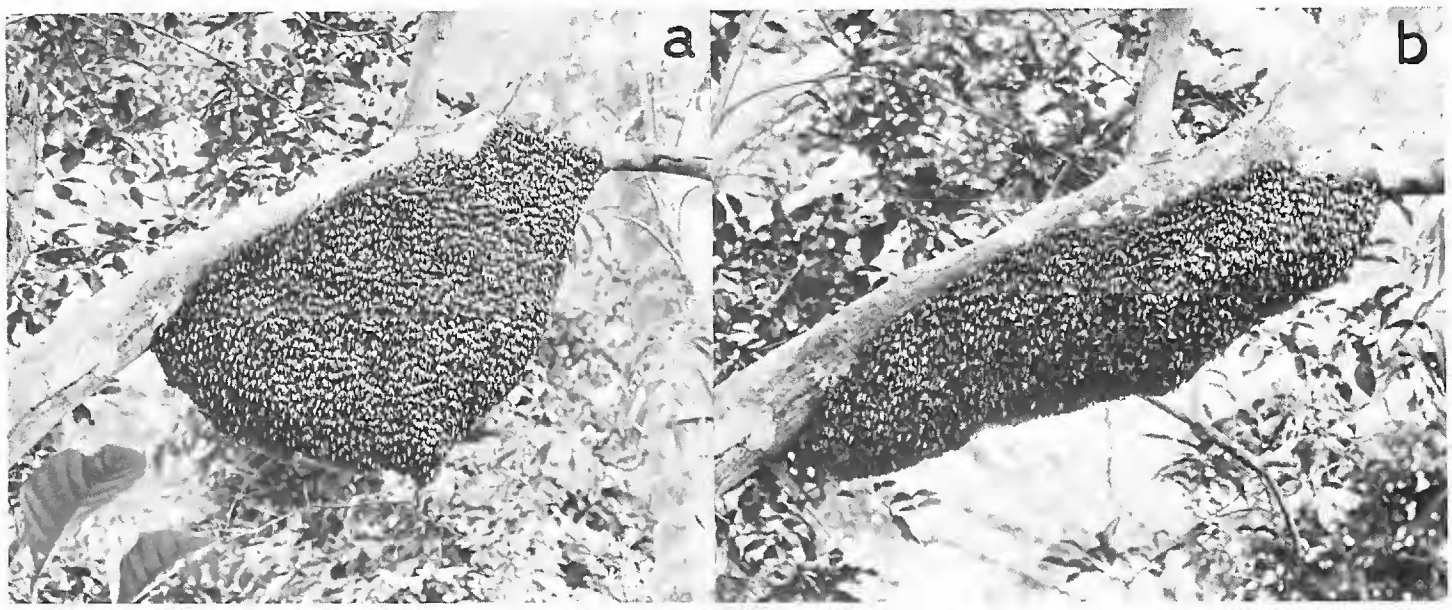


Figure 5. *A. dorsata* colony at Aborlan, Palawan, Philippines. a. As a normal colony, with bees covering a nest. b. As a swarm, resettled on the same branch after they had been driven away with smoke and the nest removed.

inaccessibility and a readiness to launch a massive attack. They reason that the depredations of humans, in particular, over the millenia must have constituted strong natural selection. The use of honey-hunting ladders today in Sabah indicates that this selection continues.

A. breviligula can launch comparable attacks against intruders (Morse and Laigo, 1969) but its nests are commonly quite accessible. It is not easy to explain this difference, unless *A. breviligula* had few natural vertebrate predators before the

arrival of humans. At present, *A. breviligula* colonies located in inhabited areas are rarely left undisturbed; instead they are usually destroyed or driven out with smoke and fire within a few days of discovery (Morse and Laigo, 1969; pers. obs.). It may be that they gain some cryptic protection by nesting lower and in denser vegetation, but the more likely hypothesis is that selection pressure from humans has until recently not been very strong in the Philippines proper.

The reason for colony aggregation in *A. dorsata* is obscure. In light of the scant available evidence, Seeley et al. (1982) tentatively concluded that the scarcity of suitable nest substrates best accounts for aggregation. Our own observations do not support this hypothesis; suitable unoccupied trees appeared plentiful in the vicinity of those with two or more active colonies.

Acknowledgments

We thank the governments of Malaysia and Sabah for permission to do research in Sabah, granted on exceptionally short notice. This study also benefited from advice and other assistance from George Lo, Vincent Au, Charles Jackson, Anthea Phillips and the Eugene Fuller family. We thank Steve Buchmann, Jim Cane, Roger Morse and Shôichi Sakagami for critical comments and Lucille Valente and Cristina Bramley for manuscript preparation.

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